**Abstract**

This paper will discuss the hardware side of a router and what happens as it processes the huge amount of data. The basis of what a router does is provide you with an internet connection, but the question is what hardware the router uses to achieve this. What is the process the data must go through when it enters a router? A simple consumer router has four building blocks: input port, switching fabric, router processor, and output ports. It is better to use a business class router as an example because it does more than just connect you to the internet, it integrates voice, video, security, and mobility. Generally, a router has controller chip/CPU, RAM, ROM, and Flash Memory, a power supply, Interfaces, Buses, configuration register and isolation transformers. In a business class router these components expand even further.

**What is a router?**

Home network device that we usually call a router, is the piece of network hardware that allows communication between your personal computer and other connected devices to the Internet.

**Basic Information**

Routers contain a processor, several kinds of digital memory that we will talk about later, and input/output interfaces. The router's memory stores an operating system. Router’s operating systems is different from the normal operating systems any personal computer could have. Examples of popular router operating systems include Cisco Internetwork Operating System and DD-WRT.

**Hackability**

A router is the first line of security from hacking into a network. Unless you don't mind a stranger accessing your networked files. Enabling the highest level of security on the router is the best way to keep your computer system and information safe from attack. You should always protect your wireless network with a password.

**How to protect your Router?**

WPA2 is currently the most secure type of wireless encryption, so make sure you use WPA2 if you can. Some old wireless devices won't support WPA, in which case you will have to use the less secure WEP instead. If you're planning to allow strangers to share your network like many businesses do, you might want to look for a router with the "guest network" feature, which allows other people to access the internet without giving them full access to your computers and sensitive data. Hardware specs like these are important to make managing your network easier. However, the more features a router has, the more expensive it's likely to be.

**Business Class vs Consumer Class Router**

Before home networking became popular, routers could be found only in the closets of businesses and schools. Each cost thousands of dollars and require special technical training to set up and manage. In a business class router, they would prioritize security, remote access and scalability. While consumer class would prioritize speed, media streaming and security. Cisco Routers know to be one of the best business class routers, they contain certain specs depending on the application and business. Take the ethernet switch made by Cisco for example, these integrated switching modules for the Cisco integrated services routers expand router capabilities by integrating Layer 2 and Layer 3 switching. Layer 2 where packets are sent to a specific port using MAC addresses and layer 3 where packets are sent based on the IP address. The biggest thing about a business router is its scalability, meaning its ability to expand as your business grows. Consumer routers usually only have one WAN port but a business router has multiple. Which allows you to connect to more than one ISP. Some features of a business class router include the following:

A Better VPN: Business-class routers can have VPN’s that can handle a lot more users and offer better security than consumer models do. A VPN will allow a user connected somewhere else to use the database as if they were working in the office and hardwired to the network.

SSL portal and SSL tunnel VPNs: These types of virtual private networks rely on Secure Sockets Layer encryption, so that users can access the network using their Web browser. Through an SSL portal VPN, users access a gateway to the secure network and present their credentials. Once authenticated, they see a Web page that acts as a portal to other services on the network. An SSL tunnel operates in a similar fashion but adds active content--Java, JavaScript, ActiveX, Flash applications, and the like--that are not accessible with an SSL portal VPN.

Virtual networks (VLANs): Known as guest networks on consumer routers, VLANs can perform the same function on a business-class router. But you can also set up other VLANs to segregate traffic on your network, so that sensitive data from one department--human resources, for instance--stays contained within that department’s own network. An entry-level business-class router is capable of supporting several virtual networks, while a high-end model can support a dozen or more.

IPv6 support: IPv6 (Internet Protocol version 6) is replacing IPv4 as the protocol for directing Internet traffic. IPv4 uses 32 bits to define an IP address, which limits the number of addresses that can be created--and that limit has almost been reached. Since IPv6 uses 128 bits to define an IP address, it can create a much larger pool of addresses. Though many new consumer routers support IPv6, it’s a crucial requirement for a business-class router.

DMZ port: If you have a computer that needs direct access to the Internet--an email or Web server, for instance--look for a router with a dedicated DMZ port. This feature will isolate that computer from the rest of your network on a dedicated subnetwork, so that if the system becomes compromised, the intruder won’t be able to gain access to the computers on your primary network.

Content filtering: This feature is the equivalent of the parental controls in a consumer router. You can block access to certain Internet content by using keywords or blacklists (prohibited URLs), or by allowing clients to access only permitted sites through a whitelist.

Wireless Distribution System (WDS): This protocol allows a wireless signal to be repeated by up to four repeaters in order to extend the network’s range. It’s increasingly common on consumer routers, too.

**Main Components of a Router**

**Memory Components**

**ROM (Read-Only Memory)**: Stores the bootstrap program and basic OS software. If the bootstrap cannot find the iOS in flash memory, then it will be loaded from Rom instead. ROM can also be cannot be erased or overwritten due to the fact that the whole ROM chip must be replaced if wanting to upgrade.

**RAM (Random Access Memory)**: It stores the routing tables and the configuration file while the router is powered on. The contents of the RAM will be lost when the router is shutdown. Referring to the bootstrap in ROM if the bootstrap finds the iOS in flash it is loaded into ram

**NVRAM (Non - volatile RAM)**: It stores the startup configuration file only if the bootstrap finds the iOS in flash. The contents in the NVRAM remain even after the router is shutdown.

**Flash Memory:**  It stores the operating system of the router. The contents in the flash memory remain even after shutdown. Flash memory can be erased or overwritten due to the IOS being upgradable.

**CPU components**

CPUexecutes the instructions of the operating system. They also perform functions such as system initialization, routing functions, and network interface control. Long periods of high router CPU utilization are undesirable due to two main reasons. High utilization can potentially increase the amount of time a router spends processing a routing change, thereby increasing route convergence time. High route convergence times can cause packet loss by increasing the window of time during which the route for a particular destination is unavailable. Further, high router CPU utilization can disrupt other tasks, such as other protocol processing, keep alive message processing and in extreme cases, can cause the router to crash.

**Buses**: There are two types of buses in a router system bus and a CPU bus. Buses are responsible for moving bits among the different components of the router. The system bus communicates between the CPU and the interfaces. The CPU bus is used by the CPU for accessing router’s memory components like NVRAM and flash memory.

**Interfaces**: They are physical connectors that connect the router to the network for packet entry and exit. They can be either attached to the motherboard or a separate module.

**Power Supply**: The power supply can be internal or external to the router. Some routers have multiple power supplies for redundancy. It can also provide power the modular components of the CPU.

**Configuration Register**: The configuration register is what decides if the router is going to boot from the IOS image or from the TFTP server. If the configuration register is not found in NVRAM then it will load from a TFTP server

**RXBOOT Image**: This is a Stripped down version of the IOS located in the router’s ROM.

**Routing Information**

Routers receive information in packets. Upon receiving the Packet, router has to follow three generic steps before it routes the packets:

* Routing
* Forwarding
* Encapsulation